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ACID RAIN IN ONTARIO: ANOTHER THREAT TO NATIVE LAND USE IN TREATIES THREE, NINE AND FIVE

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ACID RAIN IN ONTARIO: ANOTHER THREAT TO NATIVE LAND USE IN TREATIES THREE, NINE AND FIVE

by

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PREFACE

This report, prepared with the financial assistance of the Royal Commission on the Northern Environment, represents part of Pollution Probe's continuing work in the field of air pollution and acid rain.

Appendix 1 contains a description of acid rain, long distance transport and environmental effects. It is intended that this information provide a background to the discussion of acid rain as it relates to environmental impact in north and northwest Ontario.

Damage to surfaces and statuary are not discussed, nor are health effects except where they relate to mercury contamination.

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SUMMARY

The acidity of precipitation has increased over a wide area of Ontario due to the burning of fossil fuels. Approximately 50,000 Ontario lakes will become acidified and unable to support walleye, lake trout and other aquatic life within 20 years. Significant declines in forest and soil productivity are also expected over the longer term if this trend continues.

The extent of damage to the renewable resources of native communities as well as the tourist and forestry industries depends on how quickly a comprehensive abatement strategy for Ontario and the U.S. is implemented.

Severe lake acidification in the province is presently limited to the heavily impacted Shield lakes of central Ontario. Mercury contamination of fish is already widespread in the central and northern regions.

In the acid-sensitive watersheds of Treaties 3, 9 and 5, the process of lake acidification is just beginning. Emissions of sulphur dioxide from the Atikokan and Onakawana stations are expected to contribute to the acidity of rain and snow falling on Ontario.

Possible declines in fish resources and wild rice coupled with further mercury contamination are seen to pose a threat to the viability of the Cree and Ojibway domestic economy in northern Ontario.

These and other consequences of acidic precipitation underline the need for immediate action to control emissions of sulphur and nitrogen oxides.

Chapter One - INTRODUCTION

Now Acid Rain

To many native communities in northern Canada, mineral and petroleum exploration, large-scale water diversions, gas pipeline construction and other energy-related developments are seen to pose a substantial threat to their culture, domestic economy and renewable resource base (Saunders).

Now with the discovery that in recent years the acidity of rain and snow has increased sharply over a wide area of North America due to a corresponding rise in the burning of fossil fuels (Lickens), acid rain has become a threat to native people.

A review of acid loadings in northeastern North America, where the problem is considered to be severe, reveals that Indian and Inuit communities occupying the acid-sensitive regions of Ontario, Quebec and other eastern provinces have cause for concern (Map 1).

The Obvious Damage

The fall of rain and snow over North America and Europe now averages from 5 to 40 times as acidic as normal and the acidity of individual events is often much greater. Evidence of damage to acid-sensitive watersheds can readily be found. In southern Norway, trout have disappeared from hundreds of lakes and salmon, once the base of a multi-million dollar industry, have been eliminated from major rivers. In Sweden, 10,000 of the country's 90,000 lakes have been lost to acidity. Within the next two decades, 50,000 Swedish lakes will be acidic and unable to support aquatic life. In northeastern U.S., more than half of the highland lakes in the Adirondack Mountains are now highly acidic and devoid of fish. And in Canada where acid levels are as bad if not worse than those in the U.S. and Scandinavia, over 140 Ontario lakes have already become acidified. Up to 50,000 more are expected to follow within the next 2 decades (Standing Resources Development Committee).

MAP 1.

ACID-SENSITIVE LAKES IN NORTH AMERICA

Source : The LRTAP Problem in North America : A Preliminary Overview

U.S.-Canada Research Consultation Group, 1979.

From Man To Man

To the Cree and Ojibway communities in Treaties 3,9 and 5, this threat is of particular significance. In view of damage that has already occurred in Ontario and elsewhere, the reasons are clear enough.

Firstly, the most immediate and dramatic changes due to acid rain occur in low-buffered lakes and streams. Some of the most acid-sensitive watersheds in Ontario are found within the 3 treaty areas. These lakes and streams contribute significant amounts of protein to the Indian communities and in some cases form the basis of the native commercial fishery. Acid rain is now falling on these sensitive surface waters.

Secondly, the Cree and Ojibway are directly confronted with proposals by Ontario Hydro to construct a coal-fired power generator in Treaty 3 near Atikokan and a similar facility in Treaty 9 near Onakawana. Both of these generating stations will likely be allowed to emit sulphur dioxide - the major contributor to acid rain in North America. Ontario Hydro is the second largest emittor of sulphur dioxide in Ontario.

Thirdly, the continuing tragedy of mercury contamination in the English and Wabigoon river systems has served as a constant reminder that additional mercury contamination in the environment is to be avoided at all costs (Troyer, Hutchinson and Wallace). Mercury is emitted by the same sources that add to acid rain and, like acid rain, is carried long distances in the atmosphere before being deposited on lakes and forests. In addition, increases in the acidity of lake water due to acid rain and snow serves to increase the mobility of mercury found in the soils and rocks thus further contributing to mercury contamination in fish and man (Tomlinson).

Fourthly, political solutions to control emissions of acid rain-causing air pollutants in Canada and the U.S. still seem far off. In the meantime, precipitation acidity is expected to increase. Until emission abatement, energy conservation and other solutions are in place, acid rain will continue to

affect the environment of north and northwest Ontario and threaten the renewable resource base of the Cree and Ojibway.

New Directions?

At present, damage caused by acid rain in the 3 treaty areas is marginal for the most sensitive watersheds. Evidence of lake acidification elsewhere in Ontario suggests that further environmental degradation should be expected particularly if precipitation acidity increases.

The need for Ontario Government action to force a substantial reduction in sulphur and nitrogen oxide emissions has been apparent for some time. What has been less apparent is the implications that continuing political inaction holds for native land use in northern Ontario.

Chapter Two - ACID RAIN IN ONTARIO

Acid rain is considered by some to be the most serious threat to the natural environment in Ontario (see Appendix I).

Extensive lake regions of the province, lying mostly on the Canadian Shield, are highly susceptible to the effects of this widespread threat (Map 2). Nearly all of this area is already receiving rain and snow that is more acidic than normal. While the acidity in this precipitation varies, even those areas relatively remote from the large industrial sources of sulphur and nitrogen oxides have reported high acid levels. Throughout the entire Great Lakes Basin for example, precipitation averages 5 to 50 times more acidic than normal (International Joint Commission: 8). In northwest Ontario, the pH of rainfall has been lower than 4.6 (United States-Canada: 17).

The Ontario Ministry of Environment (MOE) estimates that approximately 50,000 lakes, including nearly half of Ontario's lake trout lakes, will be lost within the next 2 decades if acid loadings continue unabated (MOE: 2). This represents a loss to Ontario of more than 6 lakes per day between now and the year 2000.

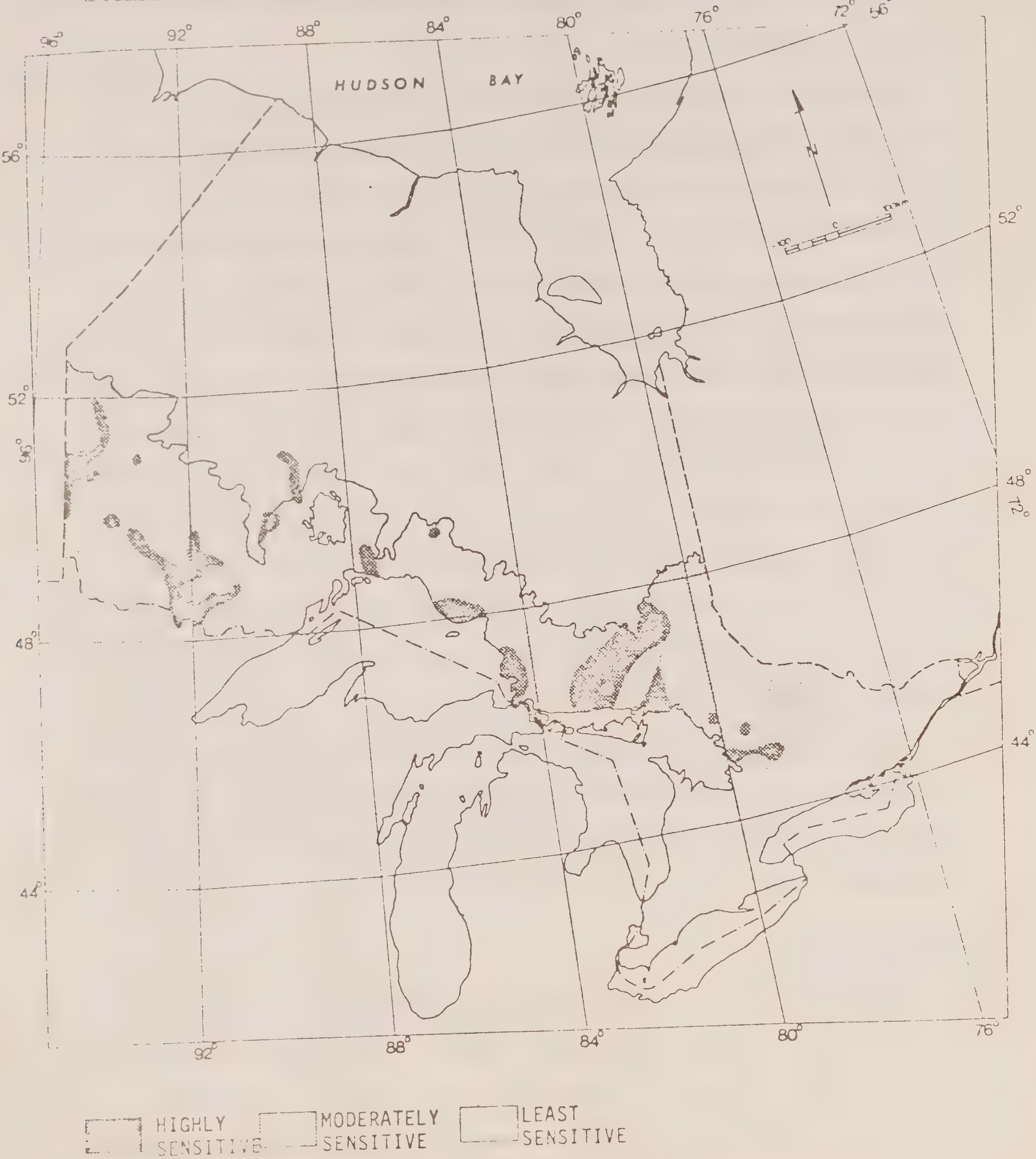
Up to 50 per cent of Ontario's $620 million sport fish industry in the Shield may be lost as a result of acid rain (Standing Resources Development Committee: 8). Few other estimates of environmental damage and costs are presently available.

Central Ontario

Those lakes and rivers most immediately threatened are located in the central Ontario regions of Haliburton, Muskoka, Parry Sound and Algonquin. Here the levels of acidity in precipitation are the highest in Ontario. The Muskoka-Haliburton region receives rain and snow that averages between 3.95 and 4.38 pH. As well, individual precipitation events as low as 2.97 pH have been reported for this region (Standing Resources Development Committee).

MAP 2.

Sensitive Surface Waters In Ontario



Source : The LRTAP Problem in North America: A Preliminary Overview

U.S.-Canada Research Consultation Group, 1979.

These acid levels are higher than those recorded in areas of Scandinavia and similar to those in northeastern U.S. where extensive ecological damage has resulted.

Acid rain effects in Ontario have shown up first in the sensitive aquatic systems of these heavily impacted central regions. Continuous acid loadings have led to the extinction of self-sustaining populations of Aurora Trout - Ontario's rarest gamefish whose natural range was limited to just 3 lakes (Bartholm). And the province has already pronounced "dead" nearly 200 acidified lakes, mostly in the La Cloche Lakes near Sudbury (MOE).

Reliable data for some of these acidified lakes reveals that over a 10 year period, lake water pH dropped from levels as high as 6.8 to levels far below which fish and other aquatic life could survive (Harvey n.d.). The sequential disappearance of individual fish species from one of these waterbodies, Lumsden Lake, is most illustrative of the dramatic changes caused by low pH (Chart 3).

In the few La Cloche lakes where fish are still found, the populations are composed entirely of older fish unable to reproduce and soon to become extinct (Harvey n.d.).

Many other central Ontario waterbodies have lost a portion of their buffering capacity due to acid rain and are contaminated by air-borne mercury (Environment Canada 1979a). These lakes are now on the brink of further ecological damage and acidification. A typical lake in Haliburton for example, was found to have lost 80 to 90 per cent of it's buffering capacity between 1967 and 1977 (Standing Resources Development Committee: 6).

North And Northwest Ontario

Except for a small portion of Ontario above 55^{0}, acid rain is falling on all of the province's north and northwest (Kramer).

According to the Ministry of Natural Resources (MNR), mercury contamination

CHART 3.

LUMSDEN LAKE SYNOPSIS

1950'S	eight species present
1960	last report of yellow perch
1960	last report of burbot
1960-5	sport fishery fails
1967	last capture of lake trout
1967	last capture of slimy sculpin
1968	white sucker suddenly rare
1969	last capture of trout-perch
1969	last capture of lake herring
1969	last capture of white sucker
1970	one fish species present
1971	lake chub very rare

Source : The Loss Of Fish And Other Organisms

H. Harvey, n.d.

of lake environments is also a widespread phenomenon in these regions (MNR 1977).

Acid-sensitive areas of most immediate concern in northern Ontario include the Algoma region, a large area north of Lake Superior and all of the northwest as far north as 53^0 (Harvey 1979).

The watersheds of these areas are comparable in vulnerability to others which have been acidified by acid rain in North America (Glass: 9). Damage to the aquatic environments is not as advanced as it is in the La Cloche Lakes or Adirondack Mountains. Acid loadings are for the most part not as high as they are in central Ontario. But with annual average precipitation pH's of 4.8 in some parts of the northwest, it is only a matter of time before ecological changes become apparent (U.S.-Canada: 17).

Already the process of lake acidification is beginning in the most susceptible headwater lakes (Kramer). Temporary depressions of lake water pH have been observed in the Quetico-Atikokan area. And a small number of sampled lakes appear to be dropping close to the 6.0 level at which some fish and other life begin to be affected (Glass, U.S.-Canada: 17). Further north, low buffered lakes above 50^0 have been found to exhibit spring pH depressions similar to those observed in central Ontario following the melt of acidified snow. Lakes with surface waters having a pH as low as 4.72 have been observed during the melt period (Ryan).

Watersheds to the extreme north and northeast are considered to be less than moderately sensitive to acidic inputs. This is due to the fact that limestone - a natural buffering agent - underlies most of the area. But reproductive disruptions of fish from temproary pH depressios and the direct effects of acid rain on forest productivity continues to be of concern.

Emission Sources

The acidity in precipitation falling on Ontario's lakes and forests can be traced to emissions of sulphur and nitrogen oxides from industrial and

urban sources located within the province. As well, analysis of dominant weather patterns in northeastern North America shows that Ontario's precipitation acidity is made worse by air pollution from the industrialized northeastern and midwestern U.S. (Ontario Hydro: I2).

Emissions from both Ontario and the U.S. affect precipitation acidity in Quebec and the Maritimes.

Sulphur dioxide is the major contributor to the acidity in rain and snow. The ratio of sulphuric acid to nitric acid in precipitation is approximately 8 to I.

In I978, Ontario sources emitted 2,I60,000 tonnes of sulphur dioxide. Over 80 per cent of this total was emitted by just 8 sources, the smelting operations of Inco, Falconbridge Mines and Algoma Steel and 5 Ontario Hydro generating stations (Chart 4).

Inco's smelting facility in Sudbury emits 3240 tonnes of sulphur dioxide per day and is the largest point source of this air pollutant in North America (Lickens).

Nitrogen oxide emissions in Ontario, produced during the high temperature burning of fossil fuels primarily in automobiles, totalled 600,000 tonnes in I978 (Standing Resources Development Committee: I4).

The U.S. annually emits approximately 25,900,000 tonnes of sulphur dioxide and 22,200,000 tonnes of nitrogen oxide. Coal-fired generating plants account for 60 per cent of this sulphur dioxide total (U.S.-Canada: 5).

Approximately 50 per cent of Ontario's acid precipitation is now thought to be from domestic sources. U.S. sources, especially those affecting northwest Ontario, account for the remainder (Kramer).

Solutions And Government Action

Like many jurisdictions in Canada and the U.S. during the last two decades, Ontario has attempted to minimize severe localized damage due to air pollution

CHART 4.

Major Emittors Of Sulphur Dioxide In Ontario, 1978

Source	Emissions (10^6 tonnes/year)	Location
INCO (1977)	1.07	Sudbury
ONTARIO HYDRO		Naticoke
		Sarnia
	.43	Bath
		Toronto
		Thunder Bay
FALCONBRIDGE (1977)	.22	Sudbury
ALGOMA STEEL	.16	Wawa
Total	1.88	

Source: Ministry of Environment, Air Resources Branch

by dispersing them into the upper atmosphere. This was often accomplished through the use of tall smokestacks. Once the diluted emissions, that included large quantities of sulphur and nitrogen oxides, finally drifted to earth hundreds to kilometers away, it was assumed that their effect on the aquatic and terrestrial environment would be negligible.

Current knowledge about the long range transport of air pollutants, at levels often within the provincially set ambient air quality standards, has shown that this approach will not prevent acidic precipitation (International Joint Commission: 26).

Ironically the "dilution solution" has actually contributed, albeit unintentionally, to the acidification of precipitation in northeastern North America and elsewhere.

If Ontario and other sources of acid-causing pollutants are to avoid further environmental damage and enormous economic and human costs, emissions of sulphur and nitrogen oxides must be substantially reduced at their source. This solution will require action on the part of the Ontario Government to implement an abatement program for all existing and proposed provincial emission sources. And because acid rain is a regional phenomenon, the province will also need to act in conjunction with the Canadian and U.S. federal governments to negotiate an air pollution agreement designed to control the transboundary movement of air pollutants. Of course Quebec and the Maritimes will benefit as much or more from these actions since they are also receiving acid rain from Ontario and U.S. sources.

This two-step solution has received the nearly unamious support of the Ontario Legislature's Standing Resources Development Committee. Following hearings last February, the 16 person all-party committee found that action at the provincial level is equally important as an international abatement treaty (Bryden). Key recommendations contained in the committee's June 1979 report called for the reinstatement of Inco's 1970 control order limiting

sulphur dioxide emissions to 675 tonnes per day, the installation of best available abatement technology on all coal-fired generating stations in the province, the incorporation of sulphur and nitrogen oxide abatement requirements in all future control orders and further research on the possible effects and costs of acid rain (Standing Resources Development Committee).

More recently the 800 delegates to the Action Seminar on Acidic precipitation (ASAP) held last November in Toronto, reaffirmed the need for government action on provincial, state and international levels. Among the resolutions adopted by the ASAP delegates were those demanding an overall reduction of sulphur and nitrogen oxides to less than 50 per cent of present levels within 10 years and the adoption of stringent emission control strategies to reduce transboundary and regional air pollution levels. Delegates also resolved that "each country adopt special siting and control policies and standards to preserve and protect existing pristine air quality parks and wildernesses". The full resolutions are contained in Appendix 2.

To their credit, Mr. John Fraser the recently-defeated federal Minister of Environment and Dr. Harry Parrott, Ontario's Minister of Environment, have recognized that acid rain is a most serious environmental danger in North America. Publically, both levels of government have expressed an intention to seek a reasonable solution to the acid rain problem and they continue to devote considerable support to ongoing research (Ontario Hydro: 40).

In his discussions with Washington, the federal minister had promised to make Canadian emission control standards as tough as those in the U.S. And he had warned that the federal government would act unilaterally to set these new pollution standards if the provinces', namely Ontario, did not move quickly enough (Environment Canada 1979b).

The recent federal election has further delayed international negotiations on an abatement treaty. It is expected to be some time before high-level talks resume. The intentions of the newly-elected Liberal Government have yet to

be spelled out.

Dr. Parrott has given the federal government a firm undertaking that Ontario will apply any new standards agreed to by the U.S. and Canada (Parrott).

In the meantime, despite the findings and recommendations of the Standing Resources Development Committee and the Action Seminar, Ontario has done little to abate the sources of sulphur and nitrogen oxides under it's jurisdiction. As yet the province does not require the installation of best-available abatement equipment on all existing or proposed coal-fired generating stations, nor will abatement requirements be automatically included in every new control order. Ontario has also refused to reinstate those stringent pollution limits for Inco's Sudbury smelter that the Environment Ministry had earlier failed to enforce under a 1970 control order.

The failure of the Ontario Government to abate the large quantities of sulphur dioxide from Inco's operation is most revealing of the approach being taken on the urgent issue of acid rain. The 1970 order required Inco to reduce emissions from their main smelter to 4,700 tonnes per day by July 1, 1972, 4,000 by December 31, 1974, 3,3000 by December 31, 1976 and 680 by December 31, 1978. Partly through the construction of a 379 meter stack, Inco cut emissions to 3,3000 tonnes per day by 1973. Improvements in the quality of the local environment have been realized as a result. But the company could not meet the 680 level because, according to Inco officials, it was not economically achievable. This argument was accepted by the Ministry of Environment despite the fact that a thorough government analysis of abatement options was not done. Without the benefit of a public review, the Ministry issued another control order setting the permissible level at the existing level of 3,300 tonnes until June 30, 1982 (Standing Resources Development Committee).

In defense of government inaction, Ontario's Minister of Environment has

argued that abatement of provincial sources alone will not control acid rain and that the final solution requires an international agreement (Parrott).

Until this agreement is in place, the MOE is considering the annual application of limestone to maintain lake water pH. But officials admit that the program would be limited to the more important recreational lakes. Liming would be far too costly for all of the 50,000 vulnerable lakes. Estimates show that the annual application of limestone to one lake in the La Cloche region would cost $ 35,000 each and every year acid rain continues to fall (Standing Resources Development Committee: 18).

Clearly Ontario's environment and economy will suffer additional damage before action is taken.

Is it reasonable then for the Ontario Government to wait for an international agreement before acting to adequately abate provincial sources? In view of the fact that these sources are affecting this province and those to the east, the answer is obvious.

Ontario's record of controlling major polluters is not an enviable one. Without firm action on the part of the province to abate Ontario sources, Ontario cannot expect to convince the U.S. to assume the enormous burden of cleaning up their existing sources. A 50 per cent reduction in sulphur dioxide emissions from eastern Canada will cost as much as $ 350 million each year. But a similar reduction in the northeastern U.S. will cost upwards of $ 7 billion.

Regardless of the extent to which the U.S. contributes to Ontario's problem, all point sources must be abated. This province does not need an international agreement to control it's own air pollutants. Moreover, an international agreement may not result in the further abatement of U.S. sources. The U.S. Environmental Protection Agency already requires up to 90 per cent reduction of sulphur and nitrogen oxides emitted from new sources. Old plants, the major problem, remain largely uncontrolled. With

President Carter's new "soft on the environment" energy policy which places increasing reliance upon domestic coal, further reductions of emissions from both new and old sources remain in doubt(International Joint Commission). The newly-created Energy Mobilization Board for example, has the power to exempt projects from existing environmental regulations. Pressure is already afoot in Minnesota and other states to ease present air quality standards (Reid).

Acid rain is actually expected to become significantly worse by the end of this century (Howard). Most reports on emissions and long range transport of acid rain predict modest increases in sulphur dioxide emissions and substantial increases in nitrogen oxide emissions if proper solutions are not implemented (Lickens).

Nitrogen oxides have tripled over the last 25 years and will probably continue to increase at that rate (U.S.-Canada: 6).

Sulphur dioxide emissions in Canada are expected to remain at present levels for non-ferrous metal smelters but increase in the utility sector. The latter may eventually rank highest in emissions of sulphur dioxide from domestic sources (U.S.-Canada: 6). Proposals to construct two new coal-fired electric power facilities in Ontario at Atikokan and Onakawana may contribute to this predicted shift between sectors.

Abatement Technology

While some advances in abatement technology will be necessary for the more unique and difficult to control industrial sources, the technology is available to control sulphur dioxide emissions from such sources as coal-fired generating stations. This technology includes low sulphur coal use, coal cleaning and flue gas desulphurization or "scrubbers".

Low sulphur coal use and coal cleaning remove up to 35 and 50 per cent, respectively, of the sulphur in coal. At a greater cost, "scrubbers" remove

up to 98 per cent of the sulphur dioxide in emissions that would normally escape into the atmosphere. Depending on the process, they also produce saleable gypsum, sulphuric acid and elemental sulphur.

Presently available equipment may also eliminate up to 60 per cent of nitrogen oxides from such sources as power generators. But lifestyle changes involving the use of smaller more fuel-efficient cars etc. will also be necessary if a reduction in nitrogen oxide emissions is to be realized.

The abatement technology is either available or, given an active government program to encourage the development of innovative technology, within grasp. All that remains between acid rain and a solution is the political will.

Chapter Three - TREATIES THREE, NINE AND FIVE

Treaties and The Land

The Cree and Ojibway peoples of what is now north and northwest Ontario, signed Treaties 3, 9 and 5 with the federal government between 1873 and 1930. The treaties established the right of Indian people occupying this area to pursue a traditional way-of-life based on hunting, fishing and gathering.

The three agreements pertain to 416,000 square kilometers of land and includes all of Ontario north of 50^{0} as well as extensive areas to the west and east further south (Map 5).

Like native people elsewhere in Canada's sub-arctic, the interest of the Cree and Ojibway in the land is both direct and profound (Watkins). While the mode of production in the native economy has changed greatly due to economic and social pressures that originated elsewhere, the Cree and Ojibway have continued to depend upon fish, wildlife, rice and other off-reserve resources (Avery and Pawlick, Adams, Sieciechowicz).

These circumstances are thought to be similar to those found in many other northern areas occupied by native people. Where extensive research on native land use and harvest has been conducted, the studies reveal that the traditional mode of production based on renewable resources is central to the culture and economy of present-day native communities (Freeman, Berger). Not only has the extent of native land use not diminished in the north but participation in the production of country food and fur remains high (Rushforth). It is precisely because of this dependance on the land that native people have consistently opposed many environmentally-threatening industrial land use operations. A preferred way-of-life is tied up with those large areas of land that produce the fish and wildlife resources.

MAP 5.

INDIAN TREATIES IN ONTARIO

Source : Native Rights In Canada

P. Cumming and N. Mickenberg (eds), 1972

For these reasons, Cree and Ojibway concerns in Northern Ontario focus on the maintenance and protection of renewable resources throughout the three treaty areas. Continued access to these resources plays a critical role in the economic and social development strategies of the 72 Indian communities who make up the majority of northern Ontario's population (Grand Council Treaty No. 3, n.d., Grand Council Treaty No. 9, 1977a).

Whether these land-based strategies are successfully implemented or not depends for the most part on how the dilemma between renewable and non-renewable resource development and between perceptions of frontier and homeland are finally resolved.

At the moment, industrial development and the resource "management" schemes of the province are viewed by participants and observers alike as substantial threats to the already shrinking Cree-Ojibway renewable resource base (Greene, Macpherson and Thompson). Environmental degradation, cultural disintegration and economic disparity are in turn seen to be the consequences for native people of development occurring in Ontario's hinterland (Rickard).

Long Range Transport

The deposition of airborne mercury throughout the three treaty areas (Environment Canada 1979a) holds similar consequences for the Cree and Ojibway. The health of people who regularly consume mercury-contaminated fish is jeopardized. Also, the presence of mercury levels above .5 parts per million (ppm) in fish preclude commercial fishing for domestic markets (Gannon).

Throughout the northwest, where most of the acid-sensitive surface waters in the treaty areas are located, MNR reports that mercury levels in fish are already at the .5 ppm level. Where industrial sources are involved, the levels are much higher. Present commercial fishing operations of Cree-

Ojibway communities as well as future growth of the fishery have been affected by these high levels. In some cases fisheries have been closed to certain lakes, in others, the harvest is limited to particular species (Chambers).

In two Treaty 3 communities -- White Dog and Grassy Narrows -- the loss of their entire fishery due to mercury pollution from an industrial source has preceeded serious social upheaval and economic disruption (Troyer). Although circumstances surrounding the abrupt closure of the fishery in 1970 differ from those in other communities, this aftermath suggests that the fish resources play a critical socio-economic role in Cree and Ojibway communities today.

Now, another threat to these resources associated with the long distance transport of air pollutants -- acid rain -- has become known. Spokesmen for Treaty 3 and Treaty 9 have already voiced their concerns about the impact of acid rain from both existing sources in the United States and Ontario and the proposed Atikokan and Onakawana generating stations in northwest and northern Ontario (Grand Council Treaty No. 3, n.d.; Grand Council Treaty No. 9, 1977b).

Acid rain and sulphate damage to once-viable native fishery and forestry operations in the Wawa, Sudbury and Parry Sound regions offers ample justification for this concern. Lakes have become acidified and forest productivity has been reduced in these areas (Roy, Gordon).

Forests And Lakes

As the preceeding chapter reveals, acid rain is falling on all of Treaty 3 and Treaty 5 and probably all of Treaty 9.

Although concern remains high, as yet there is no evidence of damage to forests and soils in northern Ontario due to acidic precipitation (Standing Resources Development Committee).

Acid-sensitive watersheds receiving acid rain are found throughout Treaties 3 and 5 and along the lower boundary of Treaty 9.

Further north in Treaty 9 the surface waters are thought to be well-buffered. But it has been suggested that the region's impervious overburden may reduce interaction between groundwaters and bedrock thus resulting in a lower buffering capacity than would normally be expected (Maclaren: 2-68).

The rate and extent of lake acidification in the 3 treaty areas is not yet known. Sampling investigations conducted by MNR, MOE, Glass, Kramer and Schindler have confirmed the presence of extremely low-buffered lakes and in some cases revealed limited changes in lake water pH due to acid inputs. Other investigators reviewing this situation have underlined the need for a comprehensive program to determine just how extensive the problem may be (Zimmerman and Harvey, Ryan).

The absence of detailed land use mapping and harvest data for all but I2 of the 72 Cree and Ojibway communities also precludes any estimates of the value of acid-sensitive watersheds to the domestic economies of surrounding communities. The need for such data has already been emphasized in an earlier report (Macpherson and Thompson). Generally, government harvest reports have been found to underestimate the importance of fish and wildlife to native communities by at least 50 per cent if not more (Usher).

Future Threats

Indian and Inuit dependence on the land in northern Canada is expected to persist. Indeed, a number of commissions of inquiry have found that the viable renewable resource sector should be given priority in the development of northern regions (Berger 1977b: 42, Lysyk: 67).

Likewise, dependence on the land is expected to remain an important feature of the Cree-Ojibway economy in northern Ontario.

Predictions that precipitation acidity will likely increase across

Ontario and evidence of severe lake acidification in central Ontario, suggests that the presently marginal acid rain problem in the north of Ontario may become worse.

Any declines in the productivity of lakes and forests will certainly conflict with the role that fish, rice, wildlife and other renewable resources play in the Cree-Ojibway economy. While it is impossible to predict just how much environmental degredation will take place (U.S.-Canada: 24) the immediate concern is that damage to lakes in central Ontario not be repeated in the 3 treaty areas.

The most eminent and probable threat of future increases in lake acidity relates to fish populations in the acid-sensitive waters of the northwest and north. A number of species figure in the native domestic economy as preferred foods and as cash sources for commercial fisherman. But concern is focussed on walleye and lake trout because these fish are among the first to be affected as pH levels drop (Ryan, Harvey n.d.).

Concern is also at a high level for two other reasons. Firstly, walleye is the most important food and commercial species in the northwest (MNR 1974:40, Maclaren: 2-77).

Secondly, the northwest supports a large percentage of Ontario's lake trout lakes (MNR 1974: 40). Nearly 800 of these lakes lie within the low-buffered Shield regions of Treaties 3,9 and 5. Lake trout have been found to be affected by declining pH before most other species partly because the clear lake trout lakes are more acidic to begin with. Throughout Ontario, only 5 per cent of trout lakes have pH values above 7.5 whereas 23 per cent of non-trout lakes exceed this value (Martin and Olver: 9).

If the aftermath of mercury pollution at Whitedog and Grassy Narrows is any indication, then it can be concluded that a decline in fish resources, particularly walleye and lake trout, holds immediate implications for food production and the generation of cash income from commercial fishing and

guiding.

A decline in fishing activities would also affect hunting success insofar as the two are related.

A second area of concern should lake water pH decline relates to mercury contamination in fish. Increases in the acidity of some Ontario lakes has been found to result in enhanced mercury uptake in fish (Suns). Any aggravation of present mercury contamination problems would certainly have adverse effects on the health of those who regularly consume fish. Moreover, high mercury levels would result in the withdrawal of commercial fishing from additional lakes. A continuation of the decline in the Cree-Ojibway renewable resource base can only contribute to present economic and social hardships and frustrate opportunities for self-sufficiency.

The productivity of wild rice, an aquatic plant known to be adversely affected by low pH levels, may also be jeopardized should lake acidification become widespread (Sain). Harvest of this plant for food and cash by native people in Treaties 3,9 and 5 is limited to the northwest and probably involves some low-buffered waters. Present problems and issues pertaining to management of this resource would also be aggravated by the effects of acid rain (Avery and Pawlick).

Over the longer term, acid rain damage is thought to affect the food supply of some mammals like otter and mink, destroy acid-sensitive lichens upon which woodland caribou depend (Peakall) and reduce the general productivity of forests and soils (see Appendix 1). These changes may disrupt trapping, caribou hunting and native forest cutting operations.

<u>Atikokan And Onakawana</u>

Whether or not acid rain becomes as much of an environmental and economic problem in Treaties 3, 9 and 5 as it appears to be in central Ontario, depends on how quickly abatement programs to control emissions of sulphur

and nitrogen oxides are put in place.

Proximity of low-buffered surface waters in northwest Ontario to U.S. emission sources in Minnesota (Kramer) means that international efforts are necessary if environmental damage is to be avoided. But the future of the 3 treaty areas also lies with the control of present and proposed emission sources in Ontario.

Of particulay worry to Treaty 3 communities is a 400 megawatt coal-fired generating station now being built by Ontario Hydro near Atikokan (Kelly). The provincial government has not required Hydro to install abatement equipment to control sulphur dioxide emissions from this new facility. It has been estimated that these emissions will violate air quality standards and increase sulphate loadings in the U.S. Boundary Waters Canoe Area (Glass). This new source, which will begin to come on stream in 1984, is also expected to increase precipitation acidity in northwest Ontario (Kramer).

The MOE maintains that this station will not add appreciably to the acid levels in rain and snow now falling on the region (Creighton).

With the renewable resource base of the Cree and Ojibway at stake, it is indeed incumbent upon the province to reconsider an earlier decision to exempt the Atikokan station from a full public and environmental review.

Another new source of sulphur dioxide in Ontario - the 1,000 megawatt Onakawana generating station - is to be constructed by Ontario Hydro in the northwest part of Treaty 9. This station is not expected to come on stream before 1990. Again, there is concern that uncontrolled sulphur dioxide emissions from this plant will also contribute to precipitation acidity in native-occupied areas (Spence).

CONCLUSIONS

The threat of acid-rain caused damage to walleye, lake trout and other renewable resources of the Cree and Ojibway in Treaties 3, 9 and 5 is indeed real.

Changes in the pH of lake water in low-buffered watersheds in the northwest are similar to those observed in the La Cloche Lakes in the late 1950's. Given the predicted increases in emissions of sulphur and nitrogen oxides in Ontario and elsewhere in North America, it is expected that serious lake acidification will become apparent over the next few decades in the acid-sensitive waters of northwest and north Ontario.

It is recognized that renewable resources continue to play an important role in the domestic economy of the Cree and Ojibway of northern Ontario. Environmental damage to fish and other resources from acidic loadings will likely jeopardize present harvest levels and conflict with the potential for growth in the renewable resource-based native economy.

Not all of the 72 Cree and Ojibway communities in Treaties 3, 9 and 5 will be equally affected by the impact of acid rain and snow. Many of the communities in the less sensitive regions bordering on Hudson Bay and James Bay will probably not be greatly affected insofar as their renewable resources are concerned. But for those Indian communities where acid rain and mercury contamination is already a problem, the loss of renewable resources holds serious economic and social implications.

Whether or not the threat of acid rain to native occupied lands in northern Ontario becomes a reality for many Cree-Ojibway communities, depends on government action to abate sulphur and nitrogen oxide emissions.

In Ontario, the MOE has done little to control acid rain-causing emissions from the 8 major sources within the province. And the government is allowing 2 new sources of sulphur dioxide to be constructed in northern Ontario

without automatically requiring that the best available abatement technology be installed.

The costs of a province-wide abatement program will indeed be high. But the costs of doing nothing may be even higher.

REFERENCES

Adams, G.

1978 "Commercial Fishing In Northern Ontario", Canadian Geographic, August and September, pp. 62-69.

Avery, K. and T. Pawlick

1979 "Last Stand In Wild Rice Country", Harrowsmith, 3(7), pp. 33-46,107.

Bartholm, G.

1979 "The Aurora Tragedy", Ontario Out Of Doors, August, pp. 43-49.

Berger, T.

1977a Northern Frontier Northern Homeland, The Report Of The Mackenzie Valley Pipeline Inquiry: Volume One. Supply and Services Canada, Ottawa.

1977b Northern Frontier Northern Homeland, The Report Of The Mackenzie Valley Pipeline Inquiry: Volume Two. Supply and Services Canada, Ottawa.

Bryden, M.

1979 "Acid Rain: A National Emergency", The Globe and Mail, July 25, 1979.

Chambers, K.

1980 Interview with Mr. K. Chambers, Regional Biologist, Ministry of Natural Resources - Northwestern Region, Kenora, February 27.

Creighton, W.

1980 Interview with Mr. W. Creighton, Chief - Water Resources Assessment, Ministry of Environment, Northwestern Region, Thunder Bay, February 27.

Environment Canada

1979a Mercury in the Canadian Environment, Environmental Protection Service.

1979b Notes for an Address by the Honourable John Fraser, Minister of the Environment, to the ASAP Conference, Toronto, November.

Freeman, M.M. (ed.)

1976 Inuit Land Use and Occupancy Project, Supply and Services Canada, Ottawa.

Gannon, J.

1978 "Acid Rain Fallout: Pollution and Politics", National Parks and Conservation Magazine, October, pp. 16-21.

Glass, G.

1979 Impacts of Air Pollutants On Wilderness Areas of Northern Minnesota, U.S. Environmental Protection Agency, Duluth, Minnesota.

Grand Council Treaty No. 3

n.d. Declaration of Rights of Treaty-3 Ojibways to Ricing, Fishing, Hunting, Trapping and Gathering.

n.d. Submission to the Royal Commission on the Northern Environment on Marmion Lake Generating Station.

Grand Council Treaty No. 9

1977a A Declaration of Nishnawbe-Aski (The People and The Land) to The People of Canada, Toronto, July 26.

1977b Submission to the Royal Commission on the Northern Environment, Timmins, Novermber 24.

Gordon, A.G.

1963 "Ecological Aspects of Air Pollution From an Iron-Sintering Plant at Wawa, Ontario", Canadian Journal of Botany, 41, pp. 1063-78.

Greene, R.

1978 Presentation to the Royal Commission on the Northern Environment, January.

H. Harold

Where Did the Fish Go?", Summary of a talk presented to the Ontario deration of Anglers and Hunters, February.

he Loss of Fishes and Other Organisms.

J.S. won't stop acid rain in time to save our lakes", The Globe and Mail, tober 16.

on, G. and D. Wallace

assy Narrows, Van Nostrand Reinhold Ltd., Toronto.

tional Joint Commission

nual Report of the Great Lakes Science Advisory Board

J.

Presentation to the Royal Commission on the Northern Environment, Preliminary hearings, Kenora, January 17.

J.

oyal Commission on the Northern Environment, Preliminary hearings, yden, November 9.

s, G.E. et al.

Acid Rain", Scientific American, 241(4), pp. 43-51.

Alaska Highway Pipeline Inquiry, Supply and Services Canada, Ottawa.

n, James F. Limited

North of 50' - Phase 11, Georgaphical Background Study, Draft Report the Royal Commission on the Northern Environment.

Macpherson, J. and G. Thompson

1977 "Polar Gas on Cree-Ojibway Lands", Bulletin (CASNP), 18(2), pp. 41-47.

Martin, N. and C. Olver

1976 The Distribution and Characteristics of Ontario Lake Trout Lakes, Ministry of Natural Resources, Fish and Wildlife Branch, Toronto.

Ministry of Environment

1979 Acidic Precipitation in Ontario.

Ministry of Natural Resources

1974a Background Information and Approach to Policy, Northwestern Ontario Planning Region, Toronto, November.

1977b Contaminant Levels in Ontario Fish: A Data Survey.

Ontario Hydro

1979 The Sources of Acid Precipitation and Its Effects on Biological Systems, Environmental Studies and Assessments Department.

Parrott, Dr. H.

1979 Letter to the Editor, The Globe and Mail, August 18.

Peakall, D.

1979 Toxic Chemicals and Wildlife, A Paper presented at the 43rd Federal-Provincial Wildlife Conference, Regina, June 26-29.

Reid, R.

1980 Notes from North Woods Acid Rain Conference, Federation of Ontario Naturalists, February.

Richard, A.

n.d. Presentation to the Man and Resources Conference, Grand Council Treaty No. 9.

Interview with Mr. Allen Roy, Union of Ontario Indians, Toronto, Ontario, January 7.

forth, S.

untry Food" in M. Watkins (ed.), Dene Nation - The Colony Within, University of Toronto Press, Toronto, pp. 32-46.

, P.A.

A report on the adverse pH characteristics observed in some West ... Lakes and potential implications of these conditions for Fisheries, West Patricia Land Use Plan, Fisheries Technical Report #6, December.

1980 Interview with Dr. P. Sain, Wild Rice Biologist, Ministry of Natural Resources, Northwestern Region, Kenora, February 26.

1973 Native People In Areas of Internal National Expansion: Indians and Inuit in Canada, International Work Group for Indigenous Affairs.

dler, D.

Interview with Dr. D. Schindler, Freshwater Institute, Winnipeg, February 29.

iechowicz, K.

1977 "The People and The Land Are One: An Introduction to the Way of Life North of 50", Bulletin (CASNP), 18(2), pp. 16-20.

1977 Submission to the Royal Commission on the Northern Environment, Timmins, November 24.

Standing Resources Development Committee

1979 Report on Acidic Precipitation, Abatement of Emission from the International Nickel Company Operations at Sudbury, and Pollution Control in the Pulp And Paper Industry.

Suns, K. C. Curry and D. Russell

1980 The Effects of Water Quality and Morphometric Parameters on Mercury Uptake by Yearling Yellow Perch, Ministry of Environment, February.

Tomlinson, G.H.

n.d. Acidic Precipitation and Mercury in Canadian Lakes and Fish, Domtar Inc., Montreal.

Troyer, W.

1977 No Safe Place, Clarke, Irwin and Company Ltd., Toronto.

Usher, P.

1976 "Evaluating Country Food in the Northern Native Economy", Arctic 29(2), pp. 105-120.

United States - Canada Research Consultation Group

1979 The LRTAP Problem in North America: a preliminary overview.

Watkins, M.

1977 "From Underdevelopment to Development" in M. Watkins (ed.), Dene Nation-The Colony Within, University of Toronto Press, Toronto, pp. 84-99.

Zimmerman, A. and H. Harvey

1979 Final Report on Sensitivity to Acidification of Waters of Ontario and Neighbouring States, Ontario Hydro, April.

APPENDIX 1

ACID RAIN: SOME ASPECTS

ACID RAIN: SOME ASPECTS

Acid rain is a dilute solution of sulphuric and nitric acids. In the most extreme instance yet reported, contaminated rainfall over Scotland in 1974 was found to be the acidic equivalent of vinegar (pH 2.4). Normal precipitation should be only slightly acid and has a pH level no lower than 5.7.

pH Explained

The pH scale, which ranges from 0 to 14, is used to measure the acidity or alkalinity of any solution. A decrease of one pH below neutral (pH 7) means a ten-fold increase in acidity and values above pH 7 indicate greater alkalinity. Using this scale it can be said that the "vinegar storm" over Scotland was nearly 1000 times as acidic as normal rainfall.

Air Pollutants

Industrial and urban emissions of sulphur and nitrogen oxides are largely responsible for the dramatic increases in precipitation acidity that have been observed in North America and Europe.

The mechanisms and processes by which these air pollutants affect precipitation acidity are complex and not well understood. It is known that some dry deposition usually occurs near the emission source. The remaining air pollutants are thought to react chemically with atmospheric water vapour to form acids.

Sulphur oxides, the major contributor to acid rain, are emitted from primary metal smelters and from facilities like coal-fired power plants. Automobile exhaust and some industrial sources account for most of the nitrogen oxides.

Long Range Transport

Precipitation acidity is aggravated by emissions of sulphur and nitrogen oxides from tall industrial stacks. These stacks distribute the pollutants over a wide area causing them to remain aloft long enough for the complex chemical changes to occur. Once emitted into the upper atmosphere, these pollutants may travel for distances of 1500 kilometers or more before falling as acids in the rain and snow.

Sensitive Areas

Approximately 1 million square miles of lake and forest areas in North America are sensitive to acid rain (Map 1). Often remote from the sources of sulphur and nitrogen oxides, these regions are characterized by thin soils, granite bedrock and soft water lakes that have a limited capacity to buffer or neutralize the acid inputs. Most of the Canadian Shield is included in this category.

Environmental Effects

The effect of acidified snow and rain on acid-sensitive areas has yet to be fully explored. But it is known that when the buffering agents in the soils and water are depleted or insufficient to neutralize heavy acid loadings, adverse changes occur in both the aquatic and terrestrial environments. These changes include the acidification of lakes, rivers and groundwater, damage to fish, plants and other aquatic life, disruption of the food chain, increased mobility of toxic heavy metals including mercury, and reduction of soil and forest productivity.

Lakes and Rivers

The aquatic environment is significantly more vulnerable over a short time frame to acid rain than the terrestrial environment. And it is in the headwater lakes that the effects of acidification first become apparent. Here, continuous acid loading -- often over less than a decade -- cause the pH of lake water to decline to abnormally low levels.

The response of fish to this increased acidity varies and may include the development of spinal deformities, reduced growth rate, disruption of spawning ability, egg and fry mortality and direct adult mortality. Certain species are also less tolerant of increasing acidity than others. As the pH of lake water begins to decline, trout and walleye are among the first to be affected. Lake trout, for example, fail to reproduce successfully even when the pH drops below 6.0.

Generally, reproductive success for most fish falls to zero at pH 5.0 and at pH 4.5 the remaining adults are killed.

At the lower pH levels the lake environment also becomes too acidic for most other forms of aquatic life. Clams, crayfish and snails are unable to form shells and they, along with the acid-sensitive from, salamander and insect populations simply disappear.

Aquatic plants are also affected by low pH. Heavily acidified lakes are reported to support only a thick mass of bottom vegetation similar in appearance to astroturf.

In turn, those birds and mammals who rely upon the aquatic food supply may also suffer.

Shock Loadings

These environmental effects are aggravated by heavy acid inputs during the spring melt of acid snow. Particularly when the melt is rapid and occurs over frozen soils, the pH of ponds, streams and lake shallows may be depressed even in moderately buffered watersheds. Coincidence of this low pH period with the spawning and hatching of lake trout, walleye, northern pike and others can result in reproductive failure. In extreme cases direct adult mortality has resulted. This temporary increase in acidity also takes place following the first heavy autumn rains.

Heavy Metals

One other factor related to lake acidification -- rising heavy metal concentrations -- further contributes to the survival problems of what fish and other organisms remain.

Heavy metals such as aluminum, mercury, lead and magnesium are bound to the soils and lake sediments at normal pH's. But the dissolving action of acidified ground and lake waters causes these metals to be released into the lake environment at levels which affect fish and other life. Aluminum found in acidified lake water is reported, in extreme instances, in concentrations 200 times higher than normal and can be the cause of fish kills.

Mercury is also found in very high levels in lake trout, walleye and other fish taken from acidifying waters. Direct deposition of mercury with the same precipitation that brings acid rain and often from the same sources, further contributes to the abnormally high levels.

Forest and Soils

On the terrestrial side, the effects of acid rain are also not well understood. But experimental evidence suggests that damage to the foliage of acid-sensitive plants like white pine, alder and lichens occurs when acid precipitation levels are very high.

Forest productivity is also thought to be affected in areas with insufficiently buffered soils. The acidified ground waters in these soils interrupt nitrogen cycling and leach important plant nutrients.

Changes in forest and soil productivity are thought to occur over the long term and as yet are not apparent where acid rain is widespread.

APPENDIX 2

ASAP RESOLUTIONS

ACTION SEMINAR ON ACID PRECIPITATION

REVISED RESOLUTIONS   November 3, 1979

WHEREAS acid precipitation has caused marked and dramatic damage to ecosystems and regional economies, rendered hundreds of lakes lifeless, decimated sport fisheries, impaired visibility, and threatened agriculture, tourism and forest industries and the public health and welfare of citizens throughout North America; and

WHEREAS existing atmospheric loades of sulphur and nitrogen oxides are directly contributing to dry deposition and rain and snow fall at least 50 times more acidic than normal, with isolated episodes reaching thousand fold increases in acidity; and

WHEREAS acid precipitation and its damages will continue to escalate as Canadian and U.S. indistries shift toward a greater reliance on coal; and

WHEREAS existing air quality standards and legal requirements are clearly inadequate to control acid precipitation, having allowed the sharp increase in long-range pollution over the last two decades; moreover, federal, state, and provincial governments, especially in the Ohio River valley and Ontario have failed to take adequate control actions; and

WHEREAS both the U.S. and Canadian governments have recognized the need for a cooperative approach to this international problem; but have not yet agreed on specific terms to further regulate sulphur and nitrogen oxide emissions.

THEREFORE, THE CITIZENS PARTICIPATING IN THIS ASAP CONFERENCE RESOLVE:

THAT each country must immediately adopt and implement a control policy for both new and existing sources to reduce the overall atmospheric loads of sulphur and nitrogen oxides to less than 50% of present levels within ten years, with regular incremental reductions during that decade.

THAT national energy policies are critical to curtailing acid precipitation, with special emphasis placed on:

a) energy conservation and renewable energy resource development as the highest priority;

b) the use of national and unconventional gas as a preferred substitute for oil in the transition period;

c) the direct use of coal encouraged only in utility and industrial boilers with best available control technology;

d) the conversion of existing facilities from oil to coal only where the resultant emission rates will not increase

THAT the international treaty now under negotiation by Canada and the U.S. must establish the goal of reducing transboundary and regional air pollution levels through the adoption and enforcement stringent emission control strategies.

THAT the participants are committed to seeing that this treaty is enforced, and that a commission of citizens from both countries should be established to monitor and report publicly on each country's record of compliance.

THAT research not be a substitute for immediate control action but that investments by both countries be increased particularly with regard to the economic and other effects of acid precipitation and associated pollutants on materials, drinking water quality, crops forests, rangelands, and aquatic ecosystems.

THAT both governments educate the general public, and especially the threatened agricultural, tourist, and forestry industries, about the dangers of acid precipitation and encourage public participation in government decision-making.

THAT new emission standards must emphasize presently available control techniques, such as coal pre-washing, use of low sulphur fuels, flue gas desulphurization and denitrification; and furthermore, that techniques to disperse emission in space or time, such as increased stack height and intermittent control systems should be prohibited.

THAT each country adopt special citing and control policies and standards to preserve and protect existing pristine air quality parks and wildernesses.

THAT workers can and must be protected from choosing between their jobs and a healthy environment.

THAT federal, provincial, and state governments participate in all available legal actions which will reduce sulphur and nitrogen oxide emissions and acid rain.